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West Europe Report

SCIENCE AND TECHNOLOGY

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WEST EUROPE REPORT

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CONTENTS

NEW MATERIALS STUDIED IN SWISS NATIONAL RESEARCH PROGRAM

Bern TECHNISCHE RUNDSCHAU in German 2 Oct 84 p 61

[Article by Prof Hans Joachim Guentherodt, institute of physics, Basel University: "Liquid, Vitreous and Synthetic Metals"]

[Text] At Basel University's institute of physics basic research into condensed matter is now going on. The Swiss National Fund is giving support to this program.

In traditional solid-state physics, the study of periodically structured materials (crystals) is of primary importance. But the field of condensed matter also includes materials such as liquids and amorphous substances which do not have a crystal lattice. The basic research program on "liquid, vitreous and synthetic metals" which is being supported by department 2 of the Swiss National Fund is primarily concerned with non-crystalline matter. Included in this group are liquid metals which are particularly relevant for our studies of the new physical properties which arise concurrently with the loss of the crystal lattice at the melting point. Closely related to the liquid metals is a more recent class of materials of the highest interest both to basic research and technical application which are referred to as metallic glasses or vitreous metals. These are metal alloys which are chilled extremely rapidly in the molten state (at the rate of about one million degrees per second) so that the liquid structure becomes frozen. These alloys then display metallic properties: in other words, they are opaque. But on the other hand, they do not have a crystal lattice such as conventional metals do: in other words, their microscopic structure is analogous to that of window pane and polymers. Their exceptional magnetic, mechanical, electrical and chemical properties make them suitable to the following technical applications: as minimum-loss transformers and magnetic shields in energy technology; as components and electronic sensors in magnetic recording technology; as corrosion-resistant and wear-resistant materials; as catalysts and nano-crystalline materials such as new permanent magnets. The real focus of our research is on ways to discover the physical principles that will help us understand the properties of the metallic glasses by means of diversified and targeted experimental analysis.

Another aspect of our research program is concerned with synthetic metals in the form of intercalated graphite compounds. These are two-dimensional layered structures produced by intercalating extraneous atoms and molecules between the graphite layers. Their electrical conductivity is comparable to that of copper and aluminum.

Modern analytical methods such as x-ray structure analysis, electron spectroscopy and scanning electron microscopy are of crucial importance in our research, one might say. Particular emphasis may be placed on the raster tunnel microscope which is our own replica of a new type of microscope developed by Binning and Rohrer at the IBM facility in Rueschlikon which is based on the vacuum tunnel principle. This has enabled us to obtain entirely new data concerning the surface properties of metallic glasses in atomic dimensions. We are currently focusing on research into the surface properties of metallic glasses and their relation to chemosorption and catalysis.

The materials analyzed by us and the up-to-date analytical methods employed also have great potential in terms of practical application. Particularly in the field of metallic glasses our basic research projects have received very meaningful financial support under one of the national research programs, i.e. No 7 which deals with "raw material and materials problems." The idea was to determine Swiss industry interest in using metallic glasses. Very specific projects on the use of metallic glasses are being undertaken with industry assistance as part of the activities of the Commission for the Advancement of Scientific Research. Metallic glasses are also being used within the context of other research projects we are engaged in--such as in medicine (pressure distribution in hip joint prosthetics) and in energy (chemical processes in a solar oven).

9478
CSO: 3698/96

AEROSPACE

FRG TO PROVIDE FUNDS FOR U.S. SPACE STATION, ARIANE 5

Duesseldorf HANDELSBLATT in German 5-6 Oct 84 p 1

[Article:"German Financial Contribution Through 1996 Will Amount to About DM 4.5 Billion"]

> [Text] hjs Bonn. The German Federal Government will participate in the construction of the American Space Station but will insist on an independent European component. At the same time, Bonn will agree to the development of a new high-performance engine for the European rocket Ariane 5. The above from an internal cabinet paper.

The final decision has to be made by the government this month since the period for announcing the nonparticipation in the American Space Station program by the European Space Agency (ESA) expires at the end of October.

The cost for greater space involvement by the FRG is large. The proposal places the costs through 1996 at DM 4.5 billion. Of this sum, DM 2.9 billion will go to participation in the American Space Station program and DM 1.6 billion is slated for the new Ariane engine with type designation HM 60.

These burdens cannot be accommodated within the framework of the federal government's proposed financial plan. Therefore, a proposal has been made to consider it in structuring and carrying forward the 1986 financial plan. According to the proposal, funds will be appropriated approximately as follows: DM 190 million for 1986, DM 372 million for 1987 and DM 526 million for 1988.

Europe's own contributory program to the American Space Station program is labeled Project Columbus. It includes
-- suitable enclosed modules for living quarters and laboratories for extended missions,
-- open unmanned platforms as carriers for highly automated experimental set ups,
-- a dedicated tender unit which permits the two elements to operate independently in free-flight phases in the vicinity of the space station, and finally
-- ground equipment which is continuously in contact with the space elements for communication and data exchange.

The new HM-60 engine for the Ariane-5 rocket shall provide the increased power required for more demanding transportation tasks. Calculations indicate that a payload capacity of about 15 tons is required for tending the space station.

According to the proposal, Program Columbus and the HM-60 Ariane-5 engine program, which are of approximately equal magnitude, will generate total costs of about DM 12.4 billion over the 1985-1996 period based on today's prices. Germany and France will share the costs; France will assume costs amounting to DM 4.5 billion. Each country will contribute about DM 500 million to the development phase.

The Columbus Program and the further development of the European Ariane booster rocket, as stated in the governmental proposal, "are for Europe not only of scientific-technical and economic importance, but they also have extraordinary political importance in the competition between industrial nations which is increasingly marked by technology."

It is further argued that in combination with the new longterm orientation of the European space organization, the two programs assure and strengthen European access to manned and unmanned space travel. This would prevent the otherwise sole access of the super powers to this domain and at the same time create the prerequisites for the future scientific utilization of the indirect and direct results which are anticipated.

"With this joint effort, Europe would erect a not to be neglected sign of its will of self assertion on the leading edge of technological development and at the same time expand its sphere of influence," so the formula. Both would also be of great value with regard to Japan's unrelenting technological offensive. A veto of the proposal and nonparticipation in the American Space Station program would be equivalent to "European capitulation" in the scientific-technological competition between the industrialized countries; in addition, alternative European programs "of comparable innovative potential" are not on the horizon.

9160
CSO: 3698/68

EUROPEAN BIOTECHNOLOGY STRATEGY, PROJECTS

Stockholm KEMISK TIDSKRIFT in Swedish Aug 84 pp 58-59

[Excerpts] In the past 5 years, over 100 new biotechnology companies have been founded in the United States. In Europe a great deal of development work in the field of biotechnology is going on in the large established companies--often in silence.

There are several differences between the United States and Europe in matters relating to biotechnology. There is also a considerably greater readiness to invest money in venture projects in the United States than in Europe.

The title of the seminar was "Industrial Biotechnology--Vision or Reality?" Included was a report commissioned by the European Federation of Biotechnology titled "Biotechnology in Europe: a Community Strategy for European Biotechnology."

Biotechnology in Europe

The European report "Biotechnology in Europe: a Community Strategy for Biotechnology" was delivered by two of its authors, Professor Dieter Behrens of Dechema and Dr Klaus Buchholtz of the Institute for Agricultural Technology and the Sugar Industry in West Germany.

Professor Behrens stressed among other things how hard it is to forge a common European policy in the field of biotechnology.

There is, for example, the division existing in the area of agriculture. Behrens asserted, however, that a European biotechnology industry based on agriculture could be competitive.

Comparing the American situation, Behrens underscored several fundamental differences:

--The difficulties in financing risk projects are greater in Europe.

--The relations between the university and industry are more rigid and obstacle-ridden.

--The entrepreneurial spirit of European researchers is considerably less than that of their brothers and sisters to the west.

--U.S. organizations at the federal level on down are considerably more interested in new developing industries.

All this explains the fact that biotechnology in Europe is being developed chiefly in large established enterprises--most often in silence, giving the impression that nothing or almost nothing is going on in Europe. It is very hard to find out what the real situation is here.

A European strategy must be flexible and able to meet changing needs. At the same time, some of the above-mentioned differences between European and American factors essential for development must be altered in Europe: e.g., by improved contact between the university and industry, increased risk taking, etc.

The European Federation of Biotechnology, with offices in Frankfurt, Paris and London, has formed eight committees to work in the following fields: applied molecular genetics, cell culture technology, downstream processing and recovery of bioproducts, education in biotechnology, environmental biotechnology, immobilized biocatalysts, safety in biotechnology and standard methods of evaluation of bioreactors and bioreactor standards.

Some examples of their activities are:

--improved methods for faster selection of agricultural products,

--development of continuous processes for production and recovery of bulk chemicals,

--synthesis of enzymes and biocatalyzers used in industry,

--increased understanding of kinetic relations in biotechnological processes and application of computer modeling systems,

--so-called downstream processing--i.e., processing and purification following biotechnical processes--frequently represents the greater portion of the process costs and is therefore critical for the entire economy,

--a comprehensive project integrating established technology and biotechnology is needed here,

--upgrading--what happens to profits, energy costs, etc. on increasing the reactor sizes and changing over to the continuous process?

--raw materials--since raw-material costs often comprise 30 to 70 percent of production costs, they are crucial for the whole economy,

--how can one make more efficient use of the "enormous investments" that have been made in reactors and tanks in water/waste-water purification plants, beer production and other industrial processes? Microbiological technology and computer technology now offer substantial opportunities for improving the processes.

A careful study comparing the "quiet and soft" European manner of approaching biotechnological questions with the American "beat-the-drums" approach ought to offer clever biotechnologists a way to find their niche.

The European report costs DM 30 and can be ordered directly from Dechema, P.O. Box 970146, 6 Frankfurt/Main 97, West Germany.

9992
CSO: 3698/70

SWEDEN: RECLAIMING METAL WITH BACTERIAL BIOMASS

Stockholm KEMISK TIDSKRIFT in Swedish Aug 84 pp 42-44, 46

[Article by Dr Anders Norberg, Perstorp AB, Ideon, Lund]

[Text] A method of recovering heavy metals by using bacteria has been developed at the Department of Technical Microbiology in Lund. The bacteria are capable of producing a polysaccharide with a high capacity for adsorbing ions. The bacterial polymer can be reused and has a much higher metal-accumulating capacity than conventional inorganic ion-exchange materials.

Why would it not be possible for nature's own means of eliminating substances that temporarily disturb the balance to be used for the purposes of humans? That question arose 5 years ago when a metal recovery project was initiated at the Department of Technical Microbiology at the Lund Institute of Technology.

In recent decades, the quantity of heavy metals in circulation around the world has increased sharply. This is due to the rapidly increasing recovery of metals from within the earth: metals in minerals deposited millions of years ago in a manner that nature thought was eternal. As flora and fauna developed, evolution adapted them to the physical and chemical conditions that were present. The pool of circulating heavy metals was low and constant. Now, however, man has disturbed the ecological balance in nature by releasing deposited metals from within the earth.

As an example, of the total quantity of cadmium released into the atmosphere (800,000 tons per year), 90 percent has its origin in anthropogenetic sources (from man).

Of course, there are simple and effective means of preventing the emission of toxic metals at specific sources. Established methods include precipitation, usually with hydroxide ions, lime, or hydrogen sulfide, or by chemical oxidation and reduction. Ion exchange is usually used to purify drinking water. Filtration is used to remove heavy metals from mine water. Electrolysis is often used to extract valuable metals from dilute solutions, evaporation for removing volatile metals such as mercury, and reverse osmosis for desalination of sea water.

Despite all these well known methods, however, large quantities of heavy metals are still released into the environment, where they cause much damage in the ecological interplay among various species.

Active Transport

Microorganisms possess varying capacities to concentrate metal ions. In addition, there are many different mechanisms for absorbing metals.

The adsorption of potassium and magnesium, both of which are necessary for microorganisms to function, occurs by active transport across the cell membrane that envelops the bacterium. The cell membrane acts as an osmotic membrane, which permits the intracellular concentration of metal ions to be several orders of magnitude higher than the metal concentration in the surrounding environment.

As an example of a high concentrating factor, mollusks can concentrate molybdenum from their surroundings to the extent that the intracellular concentration is 500,000 times higher than that of the ocean water. Despite this impressive concentrating factor, the intracellular content of molybdenum is still a modest 5 mg/g dry substance. In this case, the molybdenum acts as an electron acceptor in flavoproteins.

The element molybdenum is a necessary so-called trace element. Other metals that, in low concentrations, stimulate growth in organisms are copper, zink, and cobalt. As with potassium and magnesium, there are absorption systems specific to each metal. The transport system for magnesium in microorganisms has an especially high affinity (low K_M value) for Mg^{2+} ions and a considerably lower affinity for manganese, cobalt, and nickel. This means that other divalent cations can be absorbed by the magnesium transport system, but only in environments with extremely high concentrations of these ions.

In general, it may be said that the affinity in a metal-ion transport system is inversely proportional to the natural concentration of the metal ion. Thus, the trace elements have absorption systems with a considerably higher affinity than those of potassium and magnesium.

As indicated by the name, active transport requires energy in order to function. As a result, metal-accumulating systems based on the active absorption of ions must work with living microorganisms.

Dead Cells

The passive binding of cations to microorganisms is, basically, the opposite of active transport. In this case, the outside of the organism acts as an adsorbing agent for positively charged metal ions. The outer layer of the bacterium, the cell wall, consists to a great extent of negatively charged compounds.

This negative charge can be further increased if the cell surface is surrounded

by a polysaccharide layer. These polymers generally consist of sugar units and negatively charged acids that increase the capacity of the organism to adsorb cations. Since passive adsorption requires no energy supply, these systems work equally well with living and with dead cells.

Microorganisms also possess more refined systems for concentrating special metals. This is especially true of sparingly soluble metal compounds, such as those of trivalent iron. The cells can synthesize and release special substances that have a high affinity for binding iron. These chelating agents are called siderochromes and use oxygen as the ligand atoms. The iron chelates that are formed are then transported into the cell, where Fe^{3+} is released in a process that requires energy. The siderochrome molecule is then transported out of the cytoplasm once again, so that it can capture additional iron ions. One interesting observation that has been made is that a bacterium can utilize siderochromes synthesized by other microorganisms.

The human body possesses a unique system of internal detoxification that operates when the concentration of heavy metals rises in the blood plasma. Small proteins, so-called metallothioneins, are released by the liver. These proteins contain a larger percentage of sulfur-containing aminoacids than the level in normal proteins. Sulfur acts as a ligand for binding cadmium, copper, and zinc. Metallothionein has a high affinity for heavy metals. As a result, the quantity of metal in the blood plasma drops drastically. The further fate of complexes formed in this way is not fully known, but they are probably stored in the kidneys, from which they are gradually eliminated with the urine.

Faster Process

A comparison of the advantages and disadvantages of passive adsorption and active absorption of metals by microorganisms shows that the passive mechanism is more attractive. As mentioned above, adsorption is just as effective with dead as with living organisms. In addition, this process is faster than active transport. A saturation point usually is reached after several minutes of exposure, while the energy-dependent process may require a contact time of hours. The capacity (mg metal/g cells) is often higher for adsorption than for active absorption. This is especially true in the concentration of toxic metals, since heavy metals often inhibit metabolism in living cells, thereby interrupting the accumulation process. This problem can be solved by selecting mutants that are resistant to heavy metals, but although such organisms have been used to accumulate metals, their binding capacity is still limited. This is because the organism has acquired an increased tolerance to metal ions by blocking the pathways by which these ions enter the organism.

The organism we chose to work with, Zoogloea ramigera, is a bacterium that was originally isolated from sludge at a purification plant.

Produces Polysaccharide

Preliminary experiments showed that the organism was capable not only of binding promising quantities of copper by a passive mechanism, but also of producing an

extracellular polysaccharide, the presence of which seemed to stimulate metal binding. Not only did the polymer seem to stimulate metal concentration, but it also helped flocculate out the complex formed between the heavy metals and the biomass. Perhaps this flocculation could help simplify the separation stage after the exposure stage.

Further studies were conducted to examine the growth of the bacteria and the polymer production in greater detail.

When we cultivated the bacteria in a fermenter (figure 1) where the conditions of the process could be monitored and regulated easily, it was found that several parameters influenced the organism's production of polysaccharide.

The quantity of nitrogen in the medium determines the final content of bacterial cell mass in the cultivating liquid. The quantity of carbon source added determines the polysaccharide concentration. By adjusting the ratio of the carbon and nitrogen sources in the culture medium to a suitable value, the metabolism of the bacteria can be made to prioritize polymer production. The rate at which the polymer is synthesized is determined by the quantity of active cells (indirectly by the quantity of nitrogen that is added).

High productivity is achieved by producing a high cellular mass, but since much of the carbon source is also used to build up the cellular mass rather than to synthesize the polysaccharide, an adjustment must be made if the goal is to produce a maximum yield of polysaccharide when the cultivation is complete. Normally, 15 g polymer is formed for an initial additive of 25 g glucose. The rest of the carbon source is incorporated into the cells of the bacteria or is converted to carbon dioxide.

Inexpensive And Renewable

The product, which is removed from the fermenter after cultivation is complete, has a high viscosity, due to the high polymer content. It can be used as it is for metal concentration.

This metal concentration process is economical because the product requires no purification. If transport is required, the biomass can be frozen without losing its ion-adsorbing capacity. If large quantities of the product are to be transported over long distances, it may be necessary to reduce its water content. Since the raw product contains about 95 percent water, the increased cost of removing the polymer with alcohol in a processing facility can be offset by the reduced transportation costs.

Returning to the metal concentration process, we may establish the following criteria for a plant with optimum operating conditions:

1. The number of steps in the process should be low.
2. The adsorption material should be inexpensive and renewable.
3. The sorption capacity should be high.
4. The process should provide selective binding of valuable metals.

5. It should be easy to separate the metal-saturated complex.
6. It should be possible to release the adsorbed metal.
7. It should be possible to regenerate the adsorption material.
8. Loses of the adsorption material in the various stages of the process should be low.

The laboratory experiments showed that metal binding increased when biomass with a high level of polymer was used. In addition, it was shown that the biomass (polymer + cells) could be made to flocculate when exposed to cations at a suitable level of acidity. The flocculation process formed an aggregate of negatively charged cells, polymer chains, and positive ions. The cations are bound to the negative groups on the cell surface and the polymer chains, so that the latter are bound together by the cations, which act as bridges.

Saturation Reaction

The fact that the bacterial polymers were negatively charged was demonstrated by composition studies conducted on them. The polymer is made of glucose, galactose, and pyruvate. The carboxylic acid group in the pyruvate acts as the ligand.

The first metal concentration experiments were conducted with copper. Adding identical quantities of biomass to solutions with increasing copper concentrations and producing flocculation demonstrated that the binding process is a saturation reaction (figure 2).

Optimum flocculation of a solution containing biomass and copper occurs at pH 5.5. Flocculation of cadmium is carried out at pH 6.5 and flocculation of uranium complex begins at pH 3. These results were obtained by studying each metal separately. If these three metals are dissolved in the same flask at a low pH value and the polymer is added, it could be possible to achieve a selective sorption of uranium in the first stage, then copper, followed by cadmium, simply by slowly adjusting the pH upward. Figure 3 shows that this experiment was relatively successful. A certain overlapping may be noticed, but better separation should be possible by further refining the technology.

The flocculent mass that is formed by exposing biomass to metal ions may be readily separated by centrifugation. The pellets formed in this way, containing cells, polymer, and bound metal, may be transferred to a reactor to release the bound metal. By adding acid and by careful stirring, the metal ions may be leached out while the biomass remains in flocculent form.

Experiments with initial flocculation followed by the release and reuse of regenerated biomass are shown in figure 4. Here, a mixture of copper and cadmium has been used to demonstrate not only the release of the bound metal, but also the fact that the biomass can be used repeatedly for metal accumulation without a reduction in its binding capacity.

Continued Development

The process is highly economical because the biomass can be reused. In economic calculations for a metal accumulation facility, the cost of the adsorption material is one of the most significant expenditures. The possibility of recycling this material means that the bioadsorption process can compete with more conventional processes that use less expensive precipitating agents or work with ion-exchange technology.

The batch process for metal concentration is shown in its entirety in figure 5.

A process for the continuous treatment of metal-contaminated water also has been developed. Here, a steady flow of contaminated water and polymer passes through a reactor, in which the liquid level and the degree of acidity are monitored and regulated.

Such a system offers great flexibility with regard to the rate of dilution and other parameters of vital interest to the process. The optimum conditions for purifying water containing various metals can be determined readily by experiments in a continuous system. Figure 6 shows a continuously operating system. As shown by the figure, the continuous operation includes only the flocculation stage and not the separation, release, and recirculation. A complete facility for continuous operation is now being developed on the laboratory scale.

The bioadsorption process has several advantages over conventional methods of metal accumulation. The most important advantage is that the adsorption material can be regenerated and reused for metal binding. Another advantage is the high binding capacity of the adsorption material--at least twice as high as that of inorganic ion-exchange materials. Through further studies, we hope to make the process ion-selective.

The goal of this project is the practical application of the technology that is developed in these studies. In industrial applications, the water will have a slightly different composition than water used in the experiments described above. For example, how will high concentrations of undesirable metal ions influence the adsorption of valuable metals? This and other questions will be answered in the experiments that have recently begun. Many exciting experiments lie ahead and they will decide whether or not this technology can be used out in the field. This project is one of many biotechnology projects conducted at Perstorp AB.

The bacterium Zoogloea ramigera is cultivated in a fermenter under conditions that maximize the organism's production of extracellular polysaccharide, according to author Anders Norberg.

In laboratory experiments with binding of copper, it was shown that the polysaccharide not only stimulates binding of the metal, but also helps flocculate out the heavy metal-biomass complex that is formed.

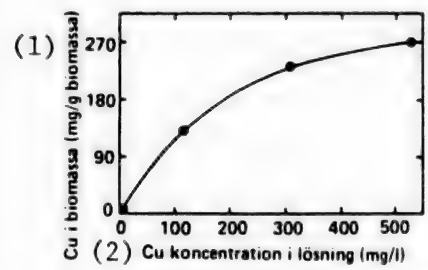


Figure 1. Sorption of copper by bacterial biomass.

Key: 1. Cu in biomass (mg/g biomass)
2. Cu concentration in solution (mg/liter)

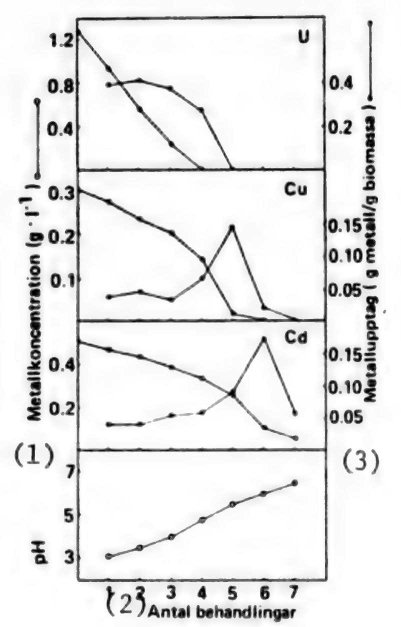


Figure 2. Selective sorption of metal.
Key: 1. Metal concentration (g/liter). 2. Number of treatments.
3. Metal sorption (g metal/g biomass).

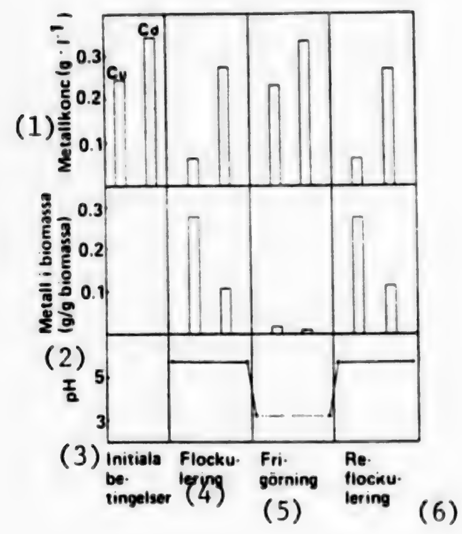


Figure 3. Flocculation, release, and recovery of biomass. Metal solution contained cadmium and copper.

Key: 1. Metal concentration (g/liter).
2. Metal in biomass (g/g biomass)
3. Initial conditions.
4. Flocculation
5. Release
6. Reflocculation

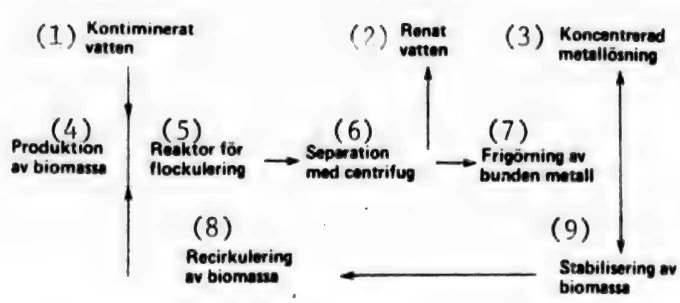


Figure 4. Process diagram of metal concentration.

Key: 1. Contaminated water.
2. Purified water
3. Concentrated metal solution
4. Production of biomass
5. Reactor for flocculation
6. Separation by centrifuge
7. Release of bound metal
8. Recirculation of biomass
9. Stabilization of biomass

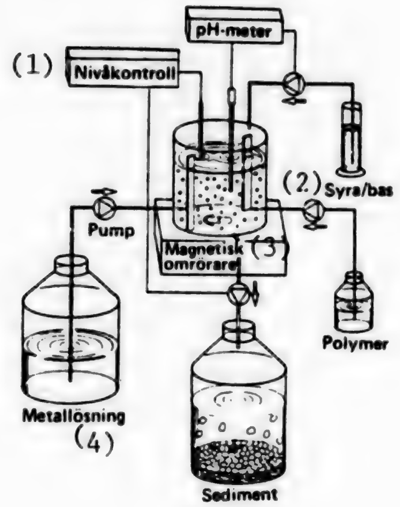


Figure 5. Continuous system for metal accumulation.

Key: 1. Level control
2. Acid/base
3. Magnetic stirrer
4. Metal solution

9336
CSO: 3698/73

CIVIL AVIATION

FRG SHARE OF A 320 EQUIPMENT INCREASES

Bonn DIE WELT in German 2 Oct 84 p 11

[Article by Hans-J. Mahnke]

[Text] The German share of equipment supplied for the new Airbus A 320 is to increase from around 17 to 25 percent. Martin Gruener, parliamentary state secretary in the Federal Ministry for Economics, reported on this successful outcome of his efforts at the annual conference of the German Aerospace Association (Deutsche Gesellschaft fuer Luft- und Raumfahrt) in Hamburg.

The increase is to affect above all high-technology equipment. On the other hand, according to Gruener, more and more of the less sophisticated Airbus components, some of which have heretofore also been supplied by the FRG, will be supplied by countries purchasing the Airbus, thereby making it easier for these countries to finance their Airbus purchases. Such countries include Australia, Indonesia and Yugoslavia, and possibly also Turkey and China. Gruener sees as particularly important German participation in the manufacture of flight control equipment, the development of which he says is being consciously supported by the German government.

Gruener indicated that in 1981 American aircraft companies were able to sell a greater number of aircraft with considerably fewer personnel than the three European aviation firms working together on the Airbus project. A manufacturing structure similar to that in the US must be established in order to increase the competitiveness of the Airbus, he said.

The German government will soon make a decision regarding distribution of funds among the partners involved in the American space station project and the European option, Gruener continued, and stated that the more generously technology transfer and commercial use of such a space station is regulated, the greater will be the benefit of participation in the American project. It simply must be considered normal for Airbus to receive orders from the US, he said.

12644
CSO: 3698/37

TA 11 DISCUSSED AS ADDITION TO AIRBUS PRODUCT LINE

Duesseldorf WIRTSCHAFTSWOCHE in German 5 Oct 84 pp 188, 190, 191

[Unattributed article: "Airbus to Have Four Engines"]

> [Text] After their successful entry into the short- and medium-range market, Europe's aircraft manufacturers want to go after America's last monopoly--the long-range Airbus A 330 is beginning to take shape.

For Reinhardt Abraham, technical director of Deutsche Lufthansa AG, the situation was clear long ago. "For me it's not at all a question of the market or the technical and economic potential for success," he theorizes again and again since becoming a proponent of a long-range four-engine Airbus. Project studies concerning such an airplane have proceeded up until now under the abbreviated designation TA 11. But now Airbus Industrie has publicized the type designation A 330--an indication that the program is very soon to become a reality.

The chances that such an aircraft would be successful are not slim. Boeing seemed to have a clear monopoly on long-range aircraft with its 747, particularly since Lockheed's L-1011 has completely disappeared from the market and McDonnel Douglas is able to keep DC-10 production going only with great effort. However the 747, due to its high capacity of 500 passengers, can only be used effectively over heavily-traveled routes; over long, so-called "thin" routes it is uneconomical.

For this reason "more and more airlines operating international flights are showing an interest in a small long-range aircraft utilizing advanced technology," Reinhard Abraham believes, "be it a replacement for the old Boeing 707 and DC-8 or for the L-1011 and DC-10 which will be ready to be replaced beginning in 1990." And in this class the A 330 with its 220 to 270 seats would indeed be without competition. "We estimate that by the year 2004 there will be a need for roughly 1300 intercontinental aircraft," Airbus's marketing director Pierre Pailleret conceded--including, however, advanced versions of the Boeing 747. Of course, whether entry into this market at the present time is advisable or not is assessed differently by Airbus Industrie and Lufthansa.

Abraham wants to give the hesitating aircraft manufacturers a shot in the arm: Together with SAS and Swissair, Lufthansa is currently assessing its requirements for such an aircraft. The result could be that these three airlines would cause production to begin by submitting a joint initial order to Airbus.

"Some airlines are pushing us in this direction," admitted Roger Beteille, General Director of Airbus Industrie. "The Australian Quantas and South African Airways are also very interested." However since each of these airlines would purchase only a relatively small number of aircraft, Airbus Industrie is still hesitant to go full speed ahead with program development.

No one can really say at this point how the program would be funded, if not by the taxpayers. Joachim Janke, ministerial council in the Federal Ministry for Economics, nevertheless sees no alternative to government funding: "The European governments will have to keep the Airbus under their wing for a long time before it will be able to stay in the air on private funds alone."

The A 330 would, however, fit extremely well into the "family plan" pursued from the beginning by the European aircraft manufacturers: The wide body would be taken almost without change from the successful A 310, therefore requiring no new investments at the Hamburg factory of MBB, where primarily Airbus fuselages are built. The wings, however, would have to be completely redesigned and tailored to long-distance flight. As all Airbus wings to date have been manufactured in Great Britain, the future of the A 330 depends on how the British view the project. Sir Austin Pierce, Chairman of British Aerospace, has already made his position clear: "My company can only participate in the A 330 project if it is financed by the government."

Boeing immediately recognized the danger represented by the A 330 program; the company wants to push new versions of the twin-engine 767 onto the market at all costs. And the Boeing 767-300 lr (long range), with a range of more than 10,000 km, could indeed absorb a large portion of the long-range market before the A 330 can even get off the ground.

The aviation authorities still have reservations about whether or not twin-engine passenger aircraft are safe enough for long-distance flights over water. Lufthansa Director Abraham is very skeptical: "We have reservations about such flights. If even the smallest problem occurs, an airline that has gone with long-range twin-engine aircraft such as these is dead." In addition, the 767-300 lr with its extended range will also be unable to cover such long distances fully loaded, because the most popular flights are non-stop flights from Europe to the west coast of the US, South America, Bangkok and Singapore, or via the polar route to Tokyo--more than 11,000 km. Airbus Industrie has calculated that distances of 7000 km and greater can be flown much more economically with four-engine aircraft than with twin-engine airliners because twin-engine aircraft are necessarily overpowered due to safety requirements in the event of engine failure.

Taking advantage of sophisticated aerodynamics, advanced lightweight construction techniques and economical engines, the A 330 should be able to achieve costs per passenger mile which are just as low as those of the Boeing 747, the

unchallenged leader in this field; the high passenger capacity of the 747 has greatly reduced specific costs. That Boeing itself does not view long-range twin-engine aircraft as the final word became known only a few weeks ago; in a paper on long-term aircraft planning, another long-range version of the 767 suddenly appeared--with four engines, like Europe's A 330.

12644
CSO: 3698/37

FRG TO TEST ADVANCED TECHNOLOGIES AIRCRAFT, 'ATTAS,' IN 1985

Bonn RHEINISCHER MERKUR/CHRIST UND WELT in German 12 Oct 84 p 16

[Article by Anatol Johansen:"German Experimental Jet for Europe's Airplane Builders"]

[Text] The big business transaction between European Airbus Industrie and Pan American World Airways, which provides for the lease/purchase option of 91 Airbuses valued at more than DM 3 billion, removes any doubt as to whether the airplanes of the Old World are at least equal to competing American models.

Certainly, this is due in part to the intensive aeronautical research which is conducted on this side of the Atlantic. The FRG is involved in this development not only through industry but also through the "Deutschen Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt" (DFVLR) [German Research and Test Agency for Aeronautics and Astronautics] and other research institutes.

The DFVLR recently announced that the new research airplane, the Advanced Technologies Testing Aircraft System (ATTAS) is approaching its first flight next February. The aircraft involved is a VFE-614 which has been undergoing modifications and equipment installation for research tasks at Messerschmitt-Boelkow-Blohm (MBB) for the past 2 years. The cabin, which was originally designed for 44 passengers, has been converted into work stations for 4 test engineers. The space also houses cabinets and consoles for instrumentation, data display units and 5 high-performance computers.

Included among the modifications which are nearing completion is the installation of electrohydraulic positioning servos. They provide "fly by wire" capability for the pilots. This means that the commands to the elevator, rudder and ailerons are electrically transmitted via wires. Small motors then position the control surfaces according to pilot's desires. In contrast, the conventional control system for airplanes employs a mechanical linkage between the cockpit and the individual control surfaces.

After the initial flight of the research aircraft and additional flight tests, the machine will be delivered in mid 1985 to the DFVLR which will then integrate another a high performance data processing system. The actual research flights of the machine will start in 1986 primarily for testing new flight-control, navigation and flight-safety systems.

9160
CSO: 3698/68

NOKIA OF FINLAND INCREASES SOFTWARE EXPORTS

Leinfelden-Echterdingen DIE COMPUTER ZEITUNG in German 19 Sep 84 p 30

[Article: "Nokia Data: On the Way to Europe"]

[Excerpt] The software exports of the Finnish company Nokia Data for industrial and commercial use have risen sharply. An example of this is the contract recently concluded between Nokia Data and the Swedish company Honeywell Bull AB, according to which Honeywell will now take over the marketing and distribution of Nokia software in Sweden. Nokia sees the agreement as a strong opening in the direction of an expansion of software exports. Last year, software amounted to 23 percent of Nokia's total sales, whereas it will rise to about 30 percent this year. According to Nokia, this is a result of conscious efforts with a view toward strengthening the software side.

The importance of software for automated systems is well known. A company that equips itself with computers today first selects good software and only then the hardware that fits that software. The marketing division of Nokia Data Information Systems produces and markets software for use in Honeywell DPS6 configurations. It mainly involves five products [as printed]:

--a system to control production and material flow (PRIMAS),

--a system for wholesale trade (HERMES),

--a special system for printshops (PAINOS),

--and a program for professional program development (NOPSA).

Nokia Data has recently developed rapidly from a typical hardware supplier into a supplier of total systems. In 1983, sales of the entire electronics group amounted to about 1.4 billion Finnish marks, of which 40 percent was attributable to the data division alone. The budgeted sales of the electronics group for this year were put at a total of 3.6 billion Finnish marks, and this figure also includes the budgeted sales of the recently acquired firms Salora and Luxor.

9746
CSO: 3698/95

COMPUTER PRODUCTS, STRATEGY AT BULL-SEMS OF FRANCE

Paris ZERO UN INFORMATIQUE HEBDO in French 24 Sep 84 p 40

[Article by Fabio Morini: "Bull-SEMS Policy After Restructuring"]

[Text] In France, today, there are two large manufacturers of all-purpose computers and microcomputers.

Too often we forget that Bull has become the leading European manufacturer. After multiple expansions and contractions (like the universe), its various minicomputer products, made by SEMS [European Minicomputers and Systems Company] or by Bull were regrouped under a single name, Bull-SEMS. This gives us an opportunity to take stock of this operation--strategy, production policy--giving special attention to the manufacturer's "new U.S. venture" with Ridge Computer.

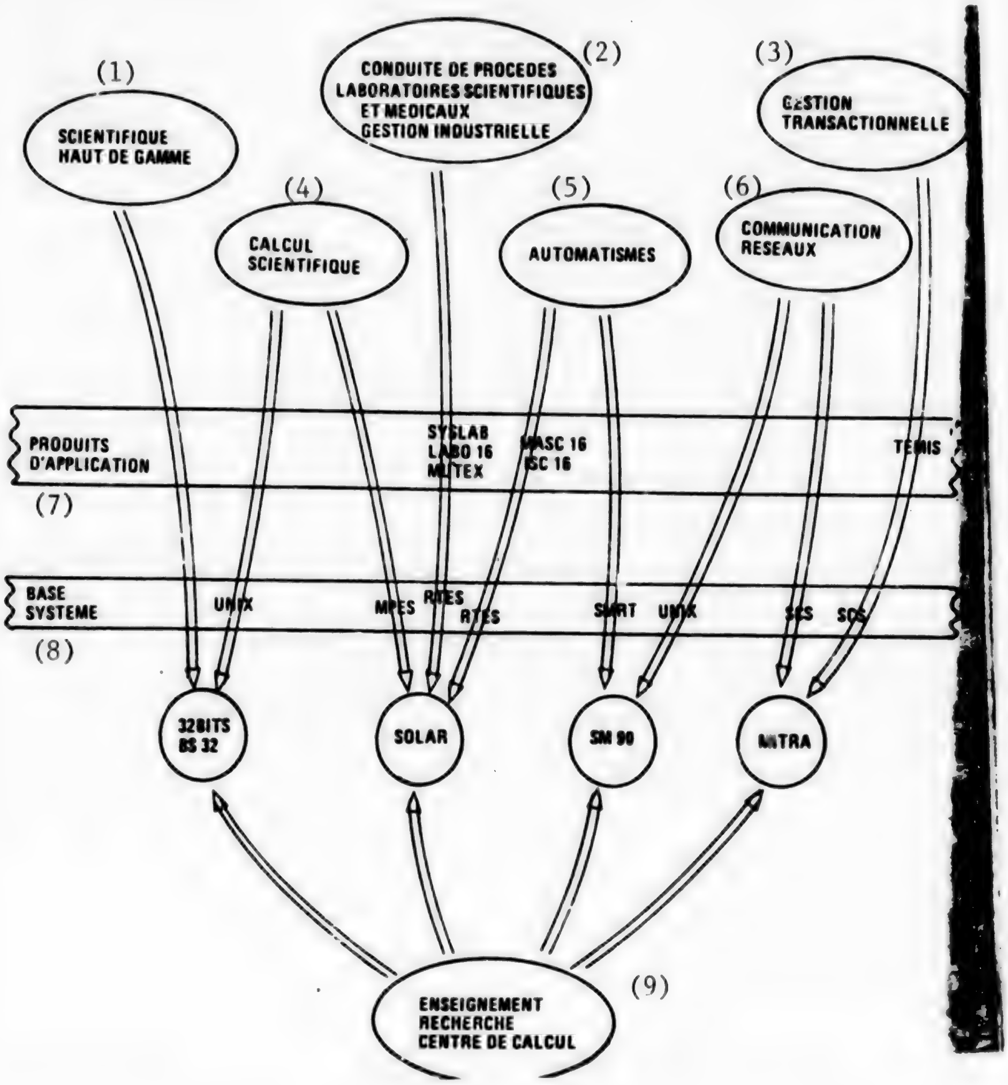
Two manufacturers born of the latest reorganization have the potential to face the formidable competition.

On the one hand, Bull whose reserves consist of the all-purpose DPS line (levels 61, DPS 4, DPS 7 and DPS 8), the Mini 6 and a few smaller machines like the Micral personal computers; on the other hand, Bull-SEMS, decidedly oriented toward minicomputers.

To be more precise, Bull-SEMS resulted from the merger of the operations of SEMS (minicomputers), Transac (terminals), R2E [Electronic Realizations and Studies] (microcomputers) and part of CII-Honeywell-Bull. It is this facet of the French data-processing industry that we are going to consider today, as we take stock of its operations, its equipment and its strategy, which was at times criticized in the past.

Bull-SEMS, the Scientific and Industrial Facet

Bull-SEMS, as it stands at the end of 1984, is a group employing over 6,600 people, which exports close to 40 percent of its production. It is therefore quite in line with the teachings of history, which tend to prove that our hexagonal borders are somewhat too tight for those who want to carve out a stable place for themselves on the computer market.



Bull-SEMS Hardware and Software Strategy

Key:

1. Scientific, top of the line
2. Process control, scientific and medical labs, industrial management
3. Transactional management
4. Scientific computing
5. Automatic operations
6. Communications, networking
7. Application products
8. System base
9. Teaching, research, computing centers

Enjoying contributions from its various components, Bull has three large sales network: France, France-consumer-oriented products, and International, which are supported by an industrial infrastructure organized around six centers: Joue-les-Tours (near Tours) for the Mini 6; Marcq-en-Baroeul (near Lille) for the T 15 terminals, the automated teller machines and the T 240 bank terminals (all the Transac operation); Belfort for peripherals, some terminals and office automation stations; Angers for the DPS 7 and DPS 8; Echirolles and Crolles (in the Grenoble area) for everything connected with the Mitra, Solar and SM 90.

Within this group, a whole sector of operations was entirely restructured and revitalized; it covers scientific and industrial minicomputers, which it inherited from the former Telemecanique and the Mitra branch of CII-Honeywell-Bull.

A New State of Mind

To an observer visiting at a one-year interval, before and after its restructuring, the former Telemecanique plant in Echirolles, which has become the nerve center of the new branch, the difference in climate is obviously considerable. In 1982-1983, all was going wrong.

The future was uncertain, as no one knew exactly what would become of him in a political and economic context that was unclear. The machine lines looked obsolete in the face of a competition that was resolutely backing 32-bit computers.

The atmosphere was morose, to say the least. All the more so as users kept railing against uncertain equipment quality and inadequate maintenance. SEMS had really reached a low point.

One year later, things have changed a lot. First, they were clarified by the restructuring and the definition of a strategy that carries on most of the former minicomputer operations. So much for the industrial aspect. But, above all, a new state of mind has settled in, and people at all levels feel a stronger commitment to what they are doing. Thanks in particular to J.P. Grunberg, the new general manager who imposed the concept of product and service quality, a concept on which he has also indexed the salaries of a number of supervisors (an index of satisfaction measured periodically through a survey of a significant sample of users).

In the scientific and industrial field, Bull-SEMS is now offering four major lines of equipment: Mitra, which it inherited from the former CII [International Data-Processing Company]; Solar, the successor of the T 1600/T 2000 of the famous Telematique company; SM 90, a brand new specialized type of equipment; and BS 32, which is what Bull is calling the Ridge 32.

The Mitra line now consists of four models: the compact Mitra 225 (introduced in 1983); the "regular" 225 (older, 1979); the 625 (1982); and at the top of the line, the 725 (the most recent since it was introduced in 1984).

These machines are decidedly 16-bit machines, which offer a particularly high performance when they are used to process transactional-management, communication and networking or real-time applications. On 1 January 1984, 7,863 Mitra had been installed, previous models included.

Considering their transactional-management orientation, we must admit that there is some competition between the Mitra and the Mini 6, whose sales for these applications are also increasing. J.P. Grundberg readily acknowledges this competition, but it does not bother him, as the Mitra are sold essentially for computer bases to be installed and for subsectors (well-defined application lines) and are not the subject of any international promotion.

In other words, the battle horse of the future is the Mini 6 which, in particular, is evolving toward 32-bit central processing units. But the Mitra remains alive and well, considering the number of installed machines and their intrinsic qualities, such as increasing functionalities and performance, with identical peripherals and couplings, compatible software or specific tools, such as an astounding disk accelerator, the Diram.

One last word on the 725, now the finest piece of the line, at any rate the most powerful, which can be used in the most diverse configurations, and is a veritable lung [as published] for Mitra supporters. And there is no reason that it should be the last one.

As for the Solar series, it now consists of only three models: the entry-level 16/35, actually a product dating back to 1975 but repositioned thanks to 1984 technology; the 16/70 and the 16/90, a top of the line model offered in single-processor or dual-processor versions.

For the time being, close to 5,600 Solar units have been installed, 60 percent of which in the context of OEM [original equipment manufacturer] sales. Throughout the years, these Solar have retained a veritable specificity, that of machines well adapted to control various processes and very suitable for scientific computing, which is to be found also in the automobile and aeronautical industries, in steelmaking, the chemical and petrochemical industries, etc.

To that end, a complete series of industrial peripherals are available, which were not thrown back into question as years went by, quite to the contrary.

The SM 90 is a very special piece of hardware. Not that it can boast of a revolutionary architecture or technology, but merely because it is the result of collaboration between the CNET [National Center for Telecommunications Studies] (hardware), the INRIA [National Institute of Data-Processing and Automation Research] (software), and Bull-SEMS for the purely industrial part. A product specially designed for telephone applications, which the world of research might eventually adopt, depending on the operating system chosen (in that case Unix).

Finally, the BS 32 is a super 32-bit minicomputer that will be manufactured at Echirolles (the first units should be available during the first quarter of 1985) under a license from Ridge Computer.

Based on the principle of an RISC (reduced instruction-set computer), the BS 32 is dedicated to scientific and graphic processing. Its capabilities include a large processing power (3 Mips), virtual-memory management, a software memory-addressing capacity of 4 billion 8-bit bytes, and the Unix system.

Since they are designed for graphics, the access terminals of the BS 32 can be very-high-resolution color graphics terminals, not necessarily those used in the Ridge configuration but--why not?--French terminals, as required by users.

Officially, the BS 32 has not yet been introduced and is therefore not listed in the Bull-SEMS catalog. However, it is no longer a secret: it is just a matter of weeks. Therefore, we shall do as if it had already been introduced...

Although it offers quite a few machines and although it is sometimes burdened by its past history, if we take a closer look we note that the Bull-SEMS strategy is inspired by a certain logic... not to say a certainty logic.

A Logic Strategy

Whatever the requester level, the manufacturer can offer a preferred solution, sometimes two, which do not necessarily overlap. Thus, in the field of communications, as far as tool management is concerned, the SM 90 can look forward to the brightest future.

That future is not necessarily "ahead" of the Solar for process control/command, monitoring and testing: in most respects, it can even be said to lie in the past, but that does not raise any question as to the durability of a line which has found its own way, as is shown by its undeniable success.

In the field of computer-aided design and, more generally, scientific computing, the BS 32 will be in the foreground, closely followed by the SM 90 which does not lack arguments in its favor. For transactional management, finally, there is not the slightest doubt that the Mini 6 will be offered to new accounts, and the Mitra for already equipped sites. Therefore, everything is for the best in the best of all possible worlds.

But, come to think of it, are Bull-SEMS sales people aware of this?

9294
CSO: 3698/86

BRIEFS

FRENCH EXPERT-SYSTEMS SPECIALIST--"France was late in getting interested in expert systems. This accounts for the small number of French products. However, several companies are developing expert systems, discreetly. In the next two years, we are going to witness the introduction of a series of operational, maybe even marketable, systems," the chief executive officer of Cognitech, one of the few French companies specializing in this field, confided. Although he is optimistic, Jean-Michel Truong-Ngoc still pointed out that some improvements are necessary in this field. First, French-made tools must become available to achieve independence from U.S. technology. This has already started with the projected construction of a French LISP machine. Then, as far as the future of expert systems is concerned, he acknowledged the need to expand their functionalities. "We have a good expertise with expert systems used for diagnostic, but much less for those capable of generating plans. Yet, this is essential in a great variety of applications, from military strategy to air-traffic regulation, and to optimize the layout of a highway." [Text] [Paris INDUSTRIES ET TECHNIQUES in French 10 Sep 84 p 21] 9294

CSO: 3698/86

METALLURGICAL INDUSTRIES

LASER, MICROCOMPUTER AUTOMATE CONTINUOUS CASTING AT BROWN BOVERI

Wuerzburg ELEKTROTECHNIK in German 6 Jul 84 pp 26-31

/Article by Dr Eng. Gerald Kröger, Dipl Eng. W. Bressner, colleagues in the business area of Industrial Systems of Brown, Boveri & Cie, AG, Mannheim/

/Excerpts/ The steel filling level in the continuous casting mold is exposed to many interfering influences based on the equipment and on the process. A new device for controlling the liquid metal level, using an electrooptic sensor for the fill level, is now capable of adapting flexibly to diverse conditions. The regulation device permits a high regulation accuracy and high regulation dynamics, automatic start of casting, as well as quick reaction in the case of process interferences.

Figure 8 shows the process of the newly developed electrooptic ladar measuring device (4). A laser transmitter emits short infrared light pulses in rapid sequence. They first run through a measurement pipe, and a deflection mirror reflects them perpendicularly to the bath surface in the mold. The pulses return from there, return along the same path back into the measurement sensor. The running time for the pulses is a measure of the distance from the bath surface to the sensor and thus is a measure of the filling level in the mold.

The ladar sensor shown in Figures 1 and 9 is installed in the area of the mold of a continuous slab casting system. The ladar measuring system offers the user a wide measuring range extending over the entire depth of the mold and a rapid, precise presentation of measured values, matched to the operating conditions.

Positioning Drive and Positioning Element

The following individual requirements are derived for the positioning drive and the positioning element:

- adequate positioning range,
- high and reproducible positioning accuracy
- a matched positioning force
- precise positional measurement
- mechanical equipment that is free of hysteresis and jamming.

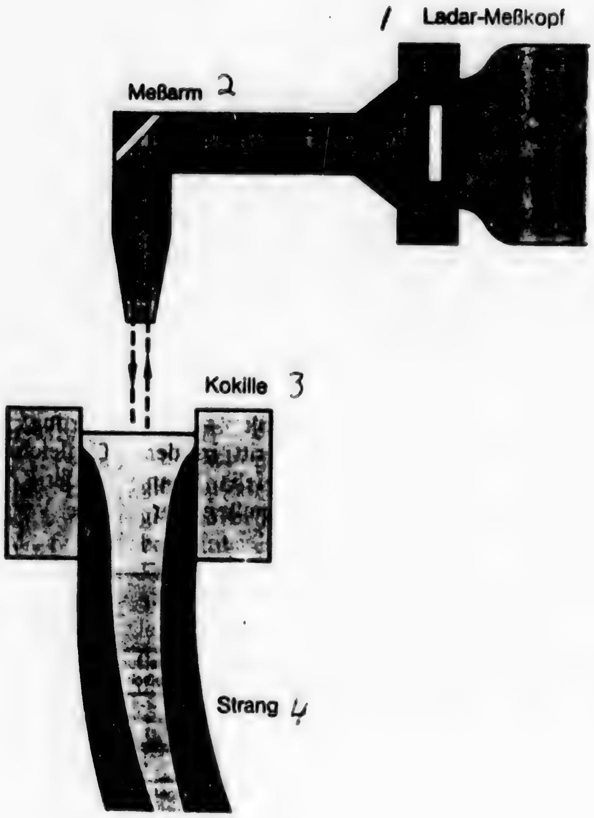


Figure 8: Functional Principle of the Electrooptic System for Measuring the Filling Level of the Mold

Key:

1. Ladar measuring head	3. Mold
2. Measuring arm	4. Strand

The flow of steel into the mold is controlled by the amount that a stopper or a slide (positioning element) is open. An electrohydraulic positioning drive, suited for the particular requirements, is used to position the positioning element. A fast and precise positioning control circuit with electrical positioning feedback controls the positioning element.

Guidance System for the Process

The present-day requirements on product quality, throughput, performance, and system availability directly impose the following requirements on the guidance system for the process:

- great precision of regulation
- high dynamics for the regulation
- adaptability to variable casting conditions
- automatic start of casting

- guided operating mode at the end of casting, interruption of casting, composite casting, etc.

- fast reaction in case of trouble.

The microcomputer system Procontic mc is used for the new regulation of the liquid metal level. It was developed for tasks involving few signals and a great linkage depth. In connection with regulating the liquid metal level, it takes over all control-, regulation-, matching-, and monitoring-tasks (7). As a rule, one microcomputer system is used per mold. In this way each casting is autonomous, and system availability remains very high even in case of trouble. In special cases (e.g. twin or triple casting), several regulation processes can also be dealt with in one guidance system.

Structure of the Guidance System for the Liquid Metal Level

The internal structure of the guidance system for the liquid metal level is shown in Figure 10. The system can readily be included within a complete process guidance system or it can also be operated autonomously, with appropriate supplementation, involving an operating and display unit.

Depending on the operation and on the current status of the process, as sensed by measurements, various automation functions will occur, such as automatic start-up of casting, stationary casting, etc. as well as trouble monitoring. These processes occur sequentially or in parallel. On the basis of algorithms that have been tested in practical operation, the theoretical control values and parameters as well as the control sequences are prescribed in a fashion that is adapted to the process, and are switched through to the inflow and outflow controls as well as the subsequent positioning devices. This achieves direct intervention into the process.

To sense the current state of the process, it is sufficient to measure the filling level, the stopper position, and the withdrawal rate, as well as to interrogate several binary operating signals.

Automatic Machines From the Start of Casting to Vibration Damping

Adaptive Automatic Machinery for the Start of Casting

The automatic starting of casting represents a significant advance in the automation of continuous casting systems. By this is understood the initial filling of the continuous casting mold before the offtake machine begins to operate. An automatic device replaces the manual control. The microcomputer system monitors the entire process of starting the casting. It runs according to prescribable times and goes over smoothly into the stationary casting operation. The mold is filled in three phases (Figure 11).

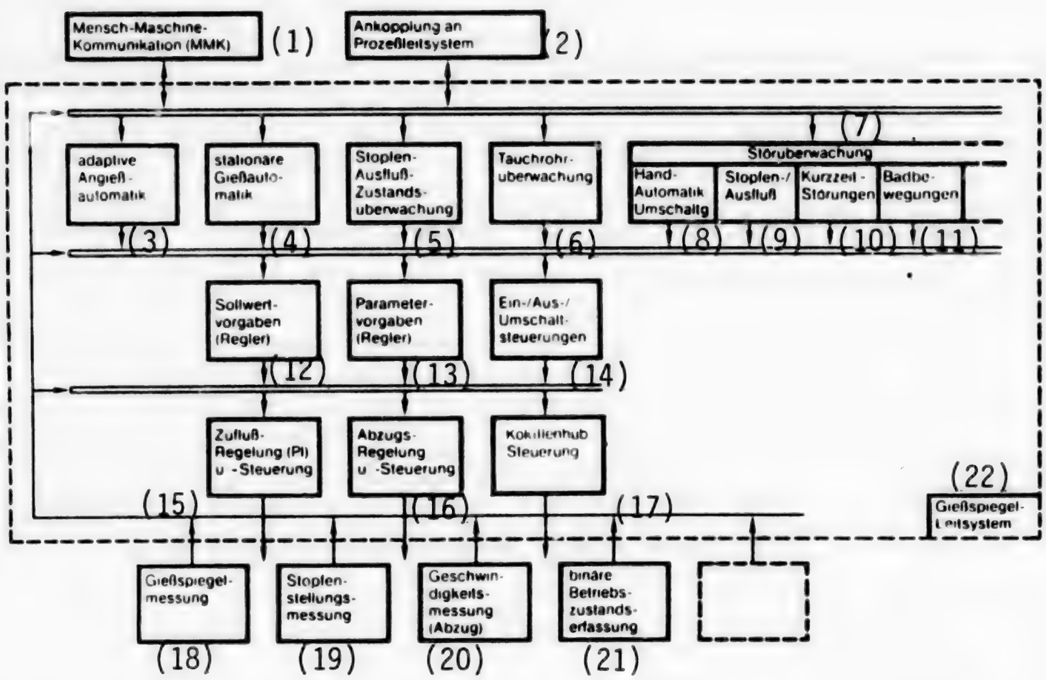


Figure 10: Schematic Representation of the Capabilities of the Guidance System for Regulating the Liquid Metal Level

Key:

1. Man-machine communication (MMK)
2. Coupling to the process guidance system
3. Adaptive automatic machinery for the start of casting
4. Automatic machinery for stationary casting
5. Monitoring the stopper outflow status
6. Monitoring the dipping cube
7. Trouble monitoring
8. Manual-automatic changeover
9. Stopper outflow
10. Short disturbances
11. Bath motions
12. Prescribed theoretical values (regulator)
13. Prescribed parameters (regulator)
14. On/off changeover controls
15. Inflow regulation (Pl) and control
16. Offtake regulation and control
17. Control of mold excursion
18. Measurement of liquid metal level
19. Measurement of stopper position
20. Measurement of speed (offtake)
21. Binary acquisition of operating status
22. Guidance system for the liquid metal level

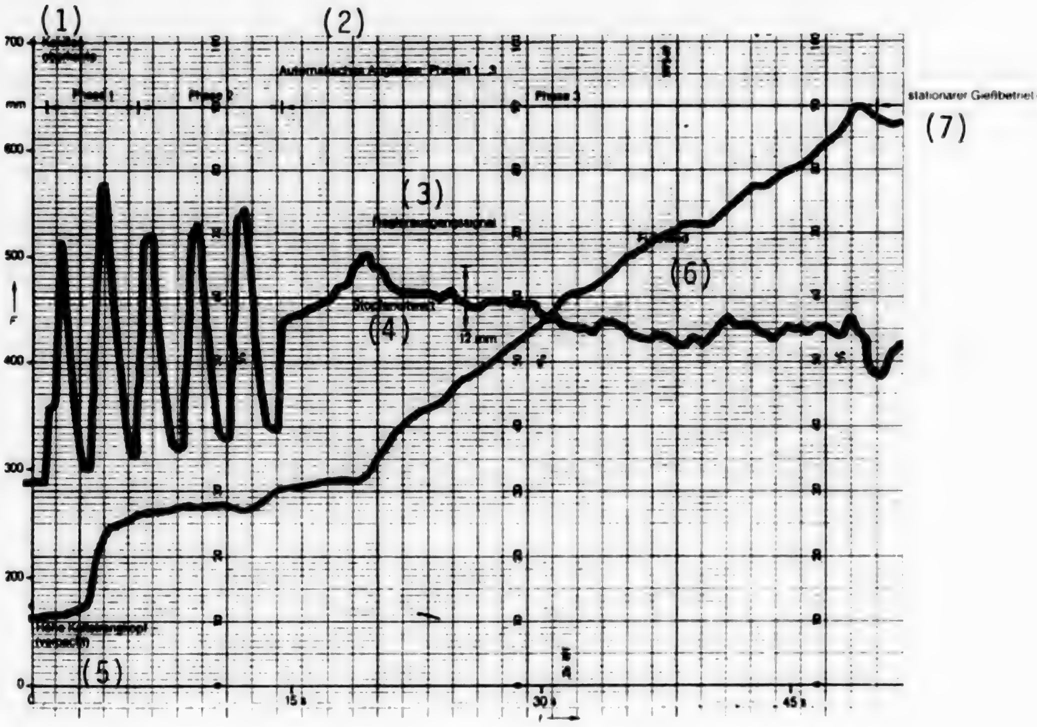


Figure 11: A Check-up Drawing of an Automatic Filling Process at a Continuous Casting Mold (the curves have been slightly time-displaced)
t = time
f - filling level in the mold

Key:
1. Upper edge of the mold
2. Automatic start of casting: Phases 1...3
3. Regulator output signal
4. Current value of the stopper
5. Height of the starting bar head (packed)
6. Filling level
7. Stationary casting operation

- Beginning of the steel inflow through suitable activation of the stopper
- Stabilizing the steel outflow behavior with an adaptive stopper activation
- Uniform, regulated filling of the mold.

All processes are constantly being checked by the guidance system. At the beginning measurement errors can occur as a consequence of severe spraying. The system will blank out such errors. Constant time monitoring and continuour adaptation of the inflow will adhere to every sensibly prescribed

casting curve. As soon as the liquid metal level in the mold has reached the stationary theoretical value, the system goes over into continuous casting operation.

An electrooptic ladar measurement system is especially suitable as a measurement transducer for the automatic start-up of casting. It has a measuring range which extends over the entire height of the mold. It offers significant advantages in the continuous monitoring of the casting start-up process.

Other functions are closely connected with the automatic start of casting. These functions initiate the start of the mold excursion and the start of the offtake machine. These signals require high reliability. For this reason they are multiply interlocked and are tested according to reliability criteria. The casting machine is subsequently accelerated to its final speed in accord with a prescribed run-up curve.

Automatic Machine for Stationary Casting

The use of proportional-integral regulators has basically proven itself in connection with regulating the liquid metal level, and has proven itself effective in this connection. Here the integral-(I)-branch contains the information concerning the instantaneously required base opening of the stopper. This depends essentially on the casting rate, the mold dimensions, and the stopper outflow properties. The proportional-(P)-branch reacts mainly to short-term deviations from regulation. Regulators with a fixed setting are only conditionally suitable with changing path parameters. An adaptive system was therefore created to regulate the liquid metal level. This system takes into account the particular boundary conditions by means of a suitable selection of parameters.

Regulator Adaptation to Changing Stopper Outflows

The form of the stopper and the outflow opening are constantly changing during the casting operation as a consequence of bake-ons and breakouts. This changes the entire control-circuit amplification. The regulator must be appropriately matched. A simple automatic process is suitable for sensing the long-term changes of amplification. The regulation parameters are subsequently adapted automatically to the new conditions.

Automatic Adjustment of Theoretical Values to Preserve the Dipping Tube

The ceramic dipping tube is subject to severe wear in the area of the bath surface. When casting several ladles (sequence casting) with the same liquid metal level, there is a risk that the dipping tube will burn through at this point. The casting personnel therefore changes the theoretical values of the filling level from time to time. The processing system makes it possible to adjust the theoretical value automatically. A low-frequency ramp function is for this purpose superposed on the basid theoretical value. The wear on the dipping tube is thus distributed over a wider area, and the lifetime of the dipping tube is extended, so that longer sequences can be cast.

Shock-free Changeover From Manual to Automatic Operation

The perfect functioning of the regulator for controlling the liquid metal level presupposes the precise sensing of the position of the positioning element. An imprecise measurement leads to severe reactions of the liquid metal level when changing over from manual to automatic operation. A take-over process that is monitored by the microcomputer system provides additional safety. Before taking over, the operator must bring the liquid metal level into the neighborhood of the theoretical value, before the automatic machinery becomes active.

Structurally Variable Regulator in the Event of Severe but Brief Interferences

To control severe but brief interferences, a special control algorithm has been developed. It is based on the linear PI-regulator. Depending on the particular status of the system, the processing system recalculates the control parameters. The regulator is designed so that a fixed minimum control deviation is not exceeded during static undisturbed operation. In the case of severe interferences, the regulator effect becomes correspondingly more drastic and balances out the system in a very short time.

Damping of the Proper Vibrations of the Bath

The new regulator concept is used in continuous casting systems for slabs with an especially effective extension. In these systems, the proper vibrations of the bath level must be damped. The regulation is characterized by adquate damping and good regulation accuracy.

Equipped Even for the Future

The new regulation system for the liquid metal level was tested for several months, in combination with a ladar filling level measuring unit, on a continuous casting system for slabs. In the meantime, it has proven its functional capability under plant operating conditions. Figure 11 shows, as an example, the record from an automatic casting start. This involves a digital regulator for the liquid metal level, drawing upon an electrooptic filling-level measuring system. In this way it is possible to satisfy all current requirements of the plant operators. The adaptability of the system furthermore opens up the possibility of inserting new algorithms and thus also fulfilling future requirements.

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8348
CSO:3698/26

SWISS FORM NEW R & D CENTER TO AID INDUSTRY

Bern TECHNISCHE RUNDSCHAU in German 25 Sep 84 pp 26, 29, 31, 33, 35

[Article by Dr Max P. Forrer, director of CSEM, Neuchatel: "Swiss R & D Facility for Modern Technologies"]

> [Text] A new R & D facility known as Centre Suisse d'Electronique et de Microtechnique SA—Recherche et Developpement [Swiss Research and Development Center for Electronics and Microtechnology Ltd] is in the process of taking up operations. It will be concerned with the modern technologies both in support of Swiss industry and in education at the university level. The article below presents an overview of issues of general interest.

The fundamental importance of the modern technologies for the international competitive position of our industry has been elaborated in countless debates over the past several years and has by now become a foregone conclusion. As a rule, small and medium-sized firms in particular are out of their depth when they not only have to keep up with fast-paced worldwide developments in technology but are called upon to make quick decisions on whether to apply and implement such developments in production. They would need more staff and more money, since mere perusal of the pertinent literature is not enough. What is really required for thorough understanding of the subject matter is personal involvement and practical application. To do this in a really meaningful way calls for more money than the small and medium-sized industrial firms can muster. The big industrial countries have therefore turned to solutions of this problem which involve the establishment of specialized research laboratories which are concerned with the industrial application of new technologies.

A Swiss solution in the field of microtechnology is now taking shape in the form of the Centre Suisse d'Electronique et de Microtechnique SA (CSEM) [Swiss Center for Electronics and Microtechnology Ltd] in Neuchatel. In the first instance, it is to become a valuable tool for Swiss industry. In addition, it is to act in support of the universities—particularly the Swiss technical universities—in the field of post-graduate and doctoral programs by providing specialized information and technical facilities.

Let me go into some detail as to what is involved in the center's emphasis on microtechnology. Microtechnology includes microelectronics, optoelectronics and peripheral components as well as micromechanics and materials research where the synergetic relationships between them are to be optimized. The peripheral components include sensors for physical and chemical variables, display elements and transductors.

CSEM Structure and Organization

CSEM was actually chartered in October 1983 but did not become operational until August 1984 following approval by the Swiss parliament on 29 February of the Federal Council decision to have the government join in the funding of a Swiss research center for microtechnology in Neuchatel and of the proposed merger of the already existing laboratories of the Swiss Foundation for Microtechnology Research, the Centre Electronique Horloger SA [Electronic Watch Center Ltd] and the Laboratoire Suisse des Recherches Horlogeres [Swiss Laboratory for Watch Research]. Initially, CSEM will consist of five scientific-technological departments.

—VLSI (Very Large Scale Integration) basic research: components; integrated digital and analog functional units; design methods for complex circuits; computer-assisted simulation aids; construction and testing of complex circuits.

—Development of integrated circuits: industrial uses of special integrated circuits (CMOS) according to customer specifications and private order contracts; development of prototypes.

—Microelectronic Technology: development and/or adoption of new processes and technologies; electronic beam lithography; application of electronic and etching processes for the production of micromechanical components, e.g. display elements, sensors, etc. Operation of a small-series production facility for integrated circuits.

—Optoelectronics and Peripheral Components: fiber optics; mechanical-optical auxiliary equipment and components for use in fiber technology; integrated optics based on silicon technology; laser printing processes; chemical sensors, piezoelectric elements.

—Micromechanics and Materials Research: thin-layer and surface technology for mechanical and electronic application; measuring devices; computer-assisted mechanical construction systems and analytical methods.

As time goes by, this organizational structure will have to adapt its work program to a large extent to the needs of industry.

The organization also includes staff positions in administration, fiscal operations, marketing and patenting. Initially, CSEM will have a staff of about 160. The first year's budget amounts to 23 million Swiss francs which includes 8 million Swiss francs in government funding for the basic research program and the necessary technical investment costs; 5 million francs from the Commission for the Avdancement of Scientific Research and the National Fund to pay for a number of research projects and 10 million francs from existing industry requests for specific research and development, for small-series production and other services.

A special effort will be made to have industrial services, development and small-series production pay for themselves. For this purpose, the departments concerned will be organized along profit lines and will be controlled by means of individual budget and accounting systems—the specific purpose here being to prevent government funds from being used indirectly to pay for private industry applications of technology. Any and all surpluses of the profit centers will be used to pay for new research projects or technological investments.

Future of Mic: chnology Research Foundation

Following its integration into the CSEM laboratories, the Swiss Foundation for Microtechnology Research will continue to exist and while maintaining close contact with CSEM its own program will change. It will coordinate the microtechnology research projects of CSEM and the universities; it will provide funding for university research projects to be conducted in CSEM laboratories; it will represent Switzerland in international research projects; it will organize training courses for industry cadres and be responsible for public relations activities.

The projected government subsidies to the foundation of 2 million francs annually, together with subsidies by the cantons, are designed to enable the foundation to perform these functions.

CSEM Basic Research Program

The focus of CSEM activities is on basic research. The actual research projects will be subject to the approval of a scientific advisory board. The purpose of the basic research program is to develop scientific-technological information; to learn new processes and to purchase and operate modern technical equipment. This will help carry out ind trial development requests and other services promptly and efficiently. The publication of research findings will therefore serve primarily as a means of communication to stir the interest of industry and under no circumstances as a mere end in itself.

In working out its research program, CSEM will have to take special consideration of the presumed needs and interests of industry—which will be no mean task. In any event, it will be extremely important for CSEM and industry to establish an open and constructive working relationship based on mutual trust.

CSEM to Be Stock Corporation

One of the reasons for CSEM incorporating itself was the justified concern about establishing an institution prepared to cooperate closely with industry and engaged in practice-oriented research. Industrial firms buying stock in CSEM may not only expect to have a voice in the selection of the board of directors and the scientific advisory board but also in the direction the research projects are to take. Given the limited funds, however, it will unavoidable that the basic research program will be based on criteria which can be subsumed under the heading of microtechnology as such—particularly in view of the broad range of expertise. Particularly in such areas of research where work has already been going on for several years industry interest will probably be the decisive factor with regard to continuing the research program. Such industry interest may manifest itself in the form of research and developments contracts; the manufacture of prototypes; small series production or licensing arrangements.

In addition to the abovementioned, government-funded basic research program, CSEM will be in a position to carry out medium-range and long-range research for individual firms, groups of firms or even entire branches of industry. Firms holding stock in CSEM will be given preferential treatment. In this way, it will be possible to engage in research in such areas which are not or are no longer part of the overall research program because they are too specialized. In principle, research projects of this type may be jointly funded by the government at 50 percent of cost—which is to say that the money would come from the Commission for the Advancement of Scientific Research.

Present stockholders of CSEM include the several institutes participating in the merger, the Landis & Gyr Corp of Zug and the Hasler Corp of Bern. At the time of the merger, the stockholders and/or members of the institutions participating in the merger will receive stock valued at the purchase price for their laboratory facilities. Subsequently, the door will be open to other stockholders. An active campaign to look for additional stockholders has already begun and is continuing. In February 1984, for example, some 45 industrial firms were invited to take part in an information session. 22 firms have already declared their intent to buy stock in CSEM.

A prospectus which will soon be available will spell out the specific rights and duties of the CSEM stockholders.

Examples of Ongoing Activities

The ongoing activities briefly outlined below are to present a picture of what foundation CSEM can build on.

Modern microelectronic methods are currently being worked on as part of National Research Programm No 13 of the Swiss National Fund. This program is concerned with technologies—or rather production processes—involving integrated circuits using microstructures down to 1 micromillimeter and concept principles for the design of complex circuits. The data obtained are needed for efficient development of new technologies, electronic elements, circuits and functional units as well as complex integrated systems. But they are also indispensable for expert advice in the case of possible purchase of industrial technology from abroad; licensing negotiations; quality control of semiconductor products purchased and professional instruction and training programs.

Industrial applications are currently being developed in the shape of 16 CMOS circuits on order from specific customers. The "design center" concerned is using 4 micromillimeter minimal geometries in its work. The specialized fields being worked on include the integration of digital and analog circuits on the same chip; minimum power consumption; nonvolatile memory; programmable filters; special microprocessors. Half of the applications take place in the watchmaking industry at this time and the other half in telecommunications, medical technology, apparatuses and metering technology. Fully developed circuits can be manufactured in limited quantities or are turned over for production to specific outside semiconductor manufacturers.

The development of sensors for physical and chemical variables has profited to a large extent from established silicon technology. Miniaturized capacitance accelerometers and high-sensitivity pressure gauges, for example, have been made of silicon by means of photolithography and etching technology. One sensor for pH measurement which is currently under development is based on an ion-sensitive silicon transistor.

In optronics, work is currently being done on fiber optical waveguides and their splice technology. Research on the production of a variety of sensors based on fiber optical waveguides is currently being conducted. Additional work is being done on thin layer waveguides on silicon substrates. Also under development are micromechanical auxiliary equipment, tools and mainpulators (with a precision factor down to 1 micromillimeter) which facilitate industrial operations using waveguides and integrated optics.

Wide-ranging research on the surface treatment of metals has led to the production of hard, corrosion-resistant, self-lubricating surfaces. Numerous practical applications in industry in a wide variety of areas are based on these research findings.

A newly developed system for the flexible, computer-assisted construction of mechanical, three-dimensional objects is ready for commercial use; it should be of particular interest to small and medium-sized industrial firms.

An ongoing service being provided to industry is the analysis of mechanical and electronic components and systems for the purpose of quality control and optimal construction.

Final Remarks

The following are the stated aims of CSEM:

—to provide service to industry in the field of microtechnology and in particular of microelectronics to help implement new research findings and thereby to support innovation in industry;

—to contribute to the cooperation with institutions of higher learning for the purpose of education and training in the abovementioned fields.

Both of these goals call for a basic research program designed to provide the most up-to-date information. The program is to be funded by the federal government.

CSEM hopes that industry will not merely call upon it to provide services but also to participate in industry undertakings by commissioning research projects in specific fields. In conclusion, I might say that CSEM is hoping for the collaboration and participation of additional industrial firms as stockholders so as to create an effective and lasting industrial partnership. Only a partnership of this kind will serve to justify government support over the long term.

9478
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FRG RESEARCHERS FIND METHOD OF BUILDING SELF-TESTING CHIP

Duesseldorf VDI NACHRICHTEN in German 28 Sep 84 p 27

[Article: "The Chip Tests Itself"]

[Text] Researchers from the Rhine-Westphalian University in Aachen and the University of Hanover have founds ways to make the interior of complex circuits more accessible. The essential result of their research is a process that has attracted attention under the designation Built-In Logic Block Observation (Bilbo).

The otherwise usual testing strategy, by which one inputs the special signal combinations, the test patterns, through the external accesses and follows the reaction at the output connections, is shifted to the interior of the chip in this test procedure. From the outside, it is only necessary to input the order for the test procedure.

The reply is limited to a signal that indicates whether or not the circuit meets the test criteria. With this procedure, the high costs in the functional test of complex circuits, which today in microelectronics are already attaining magnitudes similar to those of production costs, can be kept economically manageable. As the researchers were able to show, the additional circuit expense on the chip can generally be kept low through some simple tricks--through the shared use of already existing data registers of the circuit to be tested, for example.

The usefulness of the procedure has already been tested with the model of a 16-bit microcomputer as a test object. It was also possible to demonstrate the simultaneous self-test of all chips on an undivided wafer. The self-test can even be initiated and evaluated through an electron beam.

German manufacturers of integrated circuits have gotten some ideas from this work. It is to be expected that the current developments being supported with federal resources will soon lead to a practical application of the Bilbo in marketable components, according to information on this subject by the Federal Research Ministry, which has already supported the work of the researchers from 1977 through 1981 with DM25 million. What is special about the work of the Aachen researchers is the fact that the basic technical circuit problems are tackled in a very close interrelationship with the manufacturing processes

for the "chips." Thus extensive research was started on the manufacturing processes themselves and on their special difficulties. They thereby even developed a new process for the production of especially trouble-free silicon crystal coatings, a process that is now ready to be applied: low-pressure epitaxy, which is meanwhile playing an important role in industrial practice.

The thus acquired basic knowledge was reworked into the new ideas described. Beyond that, a number of interesting variants of elementary circuit structures from the family of the so-called bipolar technologies were developed. In the future, these can contribute to simpler development of complex circuits with strict demands on energy requirements and work speed. The overall report on the Aachen and Hanover results has appeared in the series of research reports of the Federal Ministry for Research and Technology. It can be obtained through the Technical Information Center in Karlsruhe.

9746
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SIEMENS BEGINS WORK ON 'MEGACHIP' PRODUCTION FACILITY

Bonn DIE WELT in German 12 Oct 84 p 13

[Article: "Superchip To Be Developed"]

[Text] Frankfurt--Today, Friday, Siemens AG, Munich, is laying the corner stone for a new manufacturing plant for the production of microchips. Siemens and the Dutch firm Philips Gloeilampenfabrieken NV, Eindhoven, the only two substantial European producers of microchips, are thus continuing jointly on the way to someday being able to stand up to the Japanese in the business with the important electronic storage capacities.

To that end, Siemens and Philips are working intensively on the development and organization of the production of a microchip that can store one megabit (later even four megabits) of information. For the present, the capacity of these "memories" required everywhere in electronics extends only to 250,000 bits. For this "megaproject," Philips will build a center in Eindhoven for basic and applied research in the area of the technology of VLSI circuits.

To achieve the goal of being among the first to go out in the world market offering microchips of such a large memory capacity, Siemens has planned a total of DM2.2 billion, of which DM800 million is for research and development. Siemens AG, which is counting on a "certain assistance" from Bonn, is thereby working closely with Philips, a cooperation that, according to a Siemens spokesman, extends mainly to an exchange of experience in production technology. For only with better, faster and more cost-effective production than heretofore is it possible to confront the Japanese. According to Siemens, their expenditures for microchips with larger memory capacities now amount to about DM5 to 6 billion annually.

Philips is also counting on support from the Dutch Government. In contrast to the Siemens spokesman, who was guarded in expressing himself on the financial contributions of the governments because of still-pending applications, Philips has mentioned the specific conception of 500 million gulden. Yesterday in The Hague, Dutch Economic Minister Gijsberg von Ardenne put the contribution of his government at 190 million gulden (about DM170 million); early in the year, the Federal Ministry for Research and Technology held out prospects for DM300 million.

European manufacturers play only a modest role in the competition for the world semiconductor market. According to estimates by U.S. market-research

firms, European companies are holding just under 10 percent of this $22 billion business. That could change through the purposeful cooperation of the two enterprises. The envisioned chips can store 16 (or 64) times as much data as the most efficient chip heretofore offered by the Japanese.

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FURTHER DETAILS ON SIEMENS-PHILIPS 'MEGAPROJECT'

Duesseldorf HANDELSBLATT in German 12 Oct 84 p 26

[Article: "Offensive and Aggressive Combining of Forces"]

[Text] Eindhoven/Munich--Leading managers of the Dutch company Philips have characterized the cooperative project involving Siemens and Philips in the area of sophisticated computer chips, a project financially supported by the governments of both countries, as an offensive and aggressive combination of forces and as a project of industrial-strategic importance for Europe. At a press conference at company headquarters in the Dutch city of Eindhoven on Thursday, Philips' board chairman F.C. Rauwenhoff also said that this combination of the forces of two European governments and two large enterprises that corresponds to the overall efforts of Philips in the area of integrated circuits gives Europe the unique opportunity to attain a prominent position in tomorrow's world of microelectronics.

The project envisioned under the designation Megaproject involves investments of the two partners of more than 1.5 billion Dutch florins (100florins = about DM91) for the next 5 years. The goal is the production of advanced microchip memories for integrated circuits through submicron technology. It will be used to build integrated circuits smaller than a micron (one-thousandth of a millimeter) and thus to make circuits more complex and cheaper. The governments of both countries have promised financial support for the project. The Federal Ministry for Research and Technology wants to provide about DM300 million. The Dutch economic ministry verified on Thursday its fundamental approval in the amount of 190 million Dutch florins.

Larger Subsidy in the FRG

As Rauwenhoff explained in answer to a question, the larger subsidy from the FRG, despite the fifty-fifty division of the project, is accounted for through the participation of the Philips subsidiary Valvo in Hamburg. To be sure, as the competent ministry further explained, the contribution of the Dutch Government can also be increased further through the resources of the general law for additional capital investment WIR.

According to the Dutch economic ministry, the decision of the two governments to subsidize the project was based upon considerations related to technological and industrial policy in a broader sense. The most important thought was that the development of up-to-date electronic components is of essential importance for the establishment of a competitive industry for information technology.

The tremendous pace of development in this area makes it increasingly difficult to belong to the top group in this branch. Philips and Siemens are the only enterprises in Europe that are in a position to be in this group. The two ministries in the Netherlands and Germany have arranged for further observation of the project, as in the observation of the project through a joint group of independent experts.

I.C. Krijgman from the Philips company Management Elcoma-integrierte Schaltungen also emphasized the European rank of the cooperative project. He indicated in particular the efforts of Japan, which has spent 10 percent more relative to sales than the United States for research and development in the last 10 years. If the European industry wishes to strengthen its position, then the corresponding expenditures must be raised substantially here as well. To be sure, the Esprit Program of the EEC for the promotion of up-to-date information technologies is a good beginning. But it is not enough.

In regard to the specific cooperative project, Krijgman said that together they will have a greater know-how potential, they will work faster, and they will be able to investigate more alternatives in the short term. Research and development would be more efficient and the risk considerably smaller. One can view the cooperation as an extension of the research agreement that was decided upon 2 years ago. And even before then, there had been contacts in this area, and the partners knew each other well.

Altogether, according to Rauwenhoff, Philips wants to employ 500 new people, 300 of them with academic training, in the next 2 to 3 years for the development of its activities in the area of the technology of integrated circuits. At the peak, the number of employees on the Dutch side for the Megaproject is to be estimated at 250. Experts are reckoning with about the same number on the German side. Affected by the project on the Dutch side are the production facilities at Eindhoven, the Philips factory at Nimwegen, and production for integrated circuits of the Philips subsidiary Valvo in Hamburg. A completely new technology center, the Submicron IC-Center, is to be built in Eindhoven.

The actual core of the German-Dutch cooperative project is the development of a specific product that is simultaneously to be both middle and final goal. For Philips, this is a static one-megabit memory (mega = million) under the designation SRAM (Static Random Access Memory), and the goal for Siemens is a dynamic four-megabit memory designated DRAM. Involved in both cases are so-called VLSI (Very Lare Scale Integration) circuits. In addition, the cooperation is to be directed toward the development of a common CMOS (Complementary Metal Oxide Semiconductor) technology and computer-supported design. To prepare the production of "superchips," voluminous studies are needed in automatic data processing, automatic process control, the automatic transportation of silicon plates, and the improved control of special dust-free rooms.

The word in Munich is that the cooperation between Siemens and Philips in submicron technology for electronic components is now taking on specific forms. The agreements between the two electronics concerns in this connection, however, are already quite old, as they expressly emphasize in the Siemens company. In principle, they were already made known by the board of directors in mid-July at a Siemens press conference in Stockholm (see HANDELSBLATT of 11 July).

Regensburg Works Foreseen for the Production

In the future, in the so-called "Megaproject," Siemens and Philips want above all to develop a common process technology for the production of dynamic four-megabit memories for Siemens and static one-megabit memories for Philips. The development costs are thereby to be divided about equally. Philips and Siemens develop separately and the results of this joint development in Eindhoven and Munich go both into the production in the Netherlands as well as in Germany.

This involves a typical cooperation in the precompetitive area, that is, Siemens and Philips will appear in the world market as competitors. For Siemens, about 600 engineers and technicians will be involved in the development of this project. The development takes place in Munich-Neuperlach. The megamemories will be produced in the new Regensburg works. The investment for the production will initially amount to about DM300 million. The corner stone for this new plant in Regensburg will be layed within a few days.

9746
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BRIEFS

FRG MANUFACTURING TECHNOLOGY FUNDING--The research funding program "Production Engineering" has been in operation since the beginning of the year. Its funding means have been more than exhausted by the approximately 1800 applications received by the end of August. Because of the response, the funding means from the Federal Research Ministry were already increased in April by 100 million marks to 450 million marks. There were about 1600 applications and, according to data from the BMFT (Federal Ministry for Research and Technology), the lion share of these fell to the area of business applications of computer-aided systems for development and production control. Only about 200 applications concern the funding of industrial robots and handling systems. After the received applications have been processed, the Ministry will instigate a study concomitant with the program to determine whether this funding program will really achieve the desired effects. In any case, the BMFT, according to its own data, expects an enormous push and a noticeable speed-up in the introduction of modern computer-aided systems for development and production control. [Text] [Munich COMPUTERWOCHE in German 28 Sep 84 p 51] 8348

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AUSTRIA FEELS LIKE 'SCAPEGOAT' IN WAKE OF U.S. CRITICISM

Vienna INDUSTRIE in German 10 Oct 84 pp 22-28

[Article by University Professor Dr Andreas Khol: "Technology Transfer--Hot Potato"]

> [Excerpts] "High-tech" is a new key word that commands foreign policy, but not technical discussion. Austria absolutely cannot get along without large imports. Since the deterioration in the international political situation, technology transfer to be sure is no longer just a question of industrial structure. Politics has its finger in the pie and Austria is considered a "blockade runner."

Without the use of high technology, production cannot be made efficient, unit costs for individual products cannot be reduced, new products cannot be turned out, that is, products with which we can show that we are ahead of the developing countries. High technology is indispensable for the steady modernization of the Austrian economy.

Austria needs research results of its own and an Austrian high technology; Both of these are prerequisites for so-called "smart products," in other words, those products in which Austria has a production advantage over other competitors. Research results which are available only to us in Austria signify an export headstart. High technology is thus necessary to maintain exports, to keep the economy competitive, to develop Austria further as a highly industrialized country.

Embargo Policy for High Technology

East-West relations entered a new phase with the Soviet invasion of Afghanistan in 1978: the Carter administration had to realize that its Eastern policy has failed and had to pursue a harder line. The era of detente drew to a close and yielded to a policy of strength. The Soviet Union was to be forced into moderation and disarmament through the various measures taken by the United States and its allies: on the one hand, through the restoration and constant preservation of a military balance in order thus to convince the Soviet Union also economically that there cannot be any victors in the struggle for military superiority; on the other hand, through economic measures. But before the United States moved ahead to an embargo policy in the field of high

technology, considerably less effective embargos were carried out in the field of wheat exports which were not very successful. This is why the United States looked for other, better controllable goods which cannot be delivered as easily by other producers: This is why electronics, in other words, high technology, was selected. But this had two serious consequences: the modernization of the COCOM list which became extraordinarily big, and the tightening up of American foreign trade legislation. Both of these steps are being prepared and will shortly take effect. The modernization of the COCOM list has been completed; a new American foreign trade policy is expected for the year 1985. This means sharper control of American exporters of high technology at the source. Exports going to non-NATO countries--which entail the danger that they might be shipped on to the Warsaw Pact--are now being permitted only through individual licenses, in other words, the procedure has been made more difficult.

No Special Treatment for Austria

This tightening has consequences for all European countries, as a matter of fact, for all countries. The Austrian situation is therefore nothing special--at least as regards the general problem layout. It is unusual only to the extent that the conversation atmosphere between Austria and the United States is rather tense, characterized by distrust. But all European countries are hit by the new developments, by the tightening of the COCOM list and by American foreign trade legislation, combined with the definite determination of the United States to carry these things through: that means NATO countries and non-NATO countries. The NATO countries also have a large volume of trade with the East and tightening up on the COCOM also means less exports for them. This is why there is resistance also in those countries, for example, in Great Britain, in the FRG, and in Belgium. After all, the renunciation of high technology often signifies renunciation of big orders; just recently, for example, neither United States companies nor firms from Canada were able to sell entire telephone systems to an eastern country because those systems contained structural components that were classified as strategically important. This example also points to another problem: huge orders very often contain parts that are insignificant in terms of value but that are essential nevertheless, parts that contain high technology and without which the order cannot go through; in some cases this means that orders into the billions for the East simply fall through.

High technology is being imported on a large scale. It is vital for the modernization of domestic industry. We furthermore export many goods, plant systems, and entire installations with a large measure of Austrian added value, but using imported high technology. Moreover, Austria is a kind of gateway: much imported high technology is resold without any Austrian added value, with Austria acting as jobber, above all going to countries of the Warsaw Pact. For this purpose, phony firms are being founded and their exclusive purpose is to get around the COCOM restructions through Austria.

Eastern Trade Emphasized

Duty-free zones represent a special problem here because Austria is not keeping any statistics on that. What is extraordinarily important for Austria is trade with the East--not transfer trade and not the deals designed to get around the COCOM list. This is why there have on occasion been problems in the past regarding the charge of failure to comply with the resale restrictions of the supplier firms. On top of that we have the rather ticklish export of Austrian, militarily useful technology to the East. But the entire problem complex was handled in a rather loose manner because the era of detente was characterized by the rather loose handling of export restrictions and because electronics at that time did not as yet play such a big role.

The Austrian attitude here was always clear: restrictions spelled out in purchasing contracts must be complied with--this concerns the export of foreign technology. When such purchases were made under certain conditions, care was taken to make sure that these conditions were also met during the sale phase. In legal terms, the possibilities of really preventing resale by disregarding these conditions were and are still quite scant. This means in other words that restrictions on transfer were recognized as a matter of basic principle but that there were no legal instruments to implement this basic line. There are no export restrictions in Austria (with the exception of weapons according to the weapons export law); there is no mandatory licensing obligation. Various instruments are available within the Ministry of Commerce but they are poorly developed and they are purely of a private-law nature. Quickly available instruments under the heading of sovereignty in other words, police authority, do not exist. And these weak possibilities of the Ministry of Commerce by the way exist only for imported foreign technology in case of its transfer.

Austria's In-House Technology

Austrian technology is a special and separate case: here we are dealing with research results that were developed by Austria itself. In this case, Austria acts as a sovereign state: because Austria has no restrictions on exports (apart from weapons sales), Austrian technology can be exported to all other countries without the state having any possibility of interfering, unless the corresponding products are covered by the foreign trade law--something which is not the case as a rule. Special regulations exist only for weapons and the state has certain possibilities of influencing the situation as the owner of enterprises in the nationalized industry. Special problems here involve systems that are produced in Austria and whose foreign share of high technology is so small that the entire system is considered to be an Austrian product in keeping with internationally applicable regulations as to origin.

Another aggravating factor is this: in the case of exports of foreign and domestic technology, the possibilities of interference are so small because

of the possibilities of smuggling are so tremendous; after all, this often involves goods that can be carried in a briefcase. Here is the bottom line: there is much exporting and smuggling of high technology to the East, also products that can be used in two ways, and Austria is being used here to get around the COCOM list. Many American companies have established front firms in Austria and are using there branches as a way to get the goods to the East. But one certainly cannot blame Austria alone for this situation.

New Problems in Austria

As a result of the tightening of United States foreign trade policy and the expansion of the COCOM list for foreign technology, there has been increasing pressure very recently toward a new NATO policy in Europe and also against Austria. Austria was pilloried as a special "blockade runner" in the press, above all in the United States. Austria was charged with violating treaty provisions. Threats were hinted: the fast and simple delivery of American technology to Austria in large quantities would be possible from now on only if Austria supplies effective guarantee that the items will not be passed on to the East. This basic position in itself is quite clear: if NATO carries out the policy of high-technology embargo against the Warsaw Pact, then it will certainly not accept the circumvention of that embargo through Austria. The previously mentioned telephone systems are a classical example here. If NATO firms are not allowed to deliver, then non-Austrian firms could purchase the same parts in NATO countries, they could pledge not to pass those items on, and they could then ship them to the East. The following threat has also been stated: if Austria does not guarantee that requirements connected with the importing of foreign technology are complied with when it comes to re-export, then Austria will be considered as an unreliable partner; this means that no further general export licenses will be made out to Austria; in that case, American firms will not be able to ship to Austria without restrictions, not even to meet Austrian needs. Since there is no right to purchase and sale, this will result in a real situation of dependence on the Austrian part. This is why the guarantee, to the effect that restrictions on the transfer of foreign high-technology can indeed be sustained and controlled, is important for Austria because otherwise exports to other countries, other than those of the Warsaw Pact (and they account for the lion's share) and Austrian needs as such will be endangered.

As we emphasized earlier: the Austrian situation here is not an individual, isolated problem--instead, it concerns all countries of the world, including the NATO countries in Europe. Why then is Austria selected for special branding? Here we might well suspect a political tactic which we reject most resolutely but whose causes and occasions--to the extent that they involve our own action--we must fight against: Austria is not allied with the United States and therefore any Austria-baiting criticism will not raise any problems among the allies, even though the latter are occasionally meant by that. That is one side of the coin; the other side is a bilateral relationship between Austria and the United States which is characterized by distrust and verbal radicalism. The foreign minister who left office very

recently has something to answer for here if he was unable to bridle his penchant for acidulous remarks.

American Demands Rejected

The United States thus wants to close the European breach as a whole and make Austria the scapegoat. We must reject that. Naturally, this policy hits not only Austria but also those countries that in practice benefitted from that breach: the Soviet Union and other countries of the Warsaw Pact. It was not by chance that preventive attacks were launched against the United States from that side and a connection was also established to Austria's permanent neutrality: with reference to permanent neutrality, Austria was expected to resist the wishes of the United States in this field.

Trade in peacetime of course is not governed by neutrality-law obligations, in other words, it has nothing to do with neutrality law. There is no duty to fashion foreign trade in any specific way: Austria quite on its own subjected weapons exports to certain rules also in peacetime but for foreign trade as a whole, including for goods that can be used in two ways, there are no such regulations according to international law. In other words, there are no neutrality-law restrictions on Austria's freedom to develop exports and imports of high technology according to its very own ideas.

This means that one cannot lawfully use any neutrality-law arguments to force Austria to tolerate the transfer of foreign technology which was supplied to Austrian importers on the condition that they not pass those items on. But neutrality-policy reasons cannot be advanced from the outside either: the development of its neutrality policy is a matter for Austria alone. Here is what has to be considered: cutting Austria off imports because of "bothersome" exports by Austria or denial of such exports in order to guarantee imports, in other words, is it better to give up exports to guarantee imports? The Swiss and Swedish example are decisive here: both countries have subjected high-tech exports to very strict control regulations for the purpose of securing their own imports.

Austrian high technology is a case which should be judged in an entirely different fashion. Control over real Austrian high technology is exclusively within the purview of Austria. In contrast to technology imported from foreign countries under certain conditions, we can export our own Austrian technology wherever we want to. All demands--including those of the United States and other NATO countries--have no foundation in law. The development of export policy is a free Austrian decision. Here again there are no neutrality-law restrictions in peacetime and in wartime there is the rule, for civilian goods, to the effect that normal peacetime trade remains in force. This free development of Austrian exports however must take place according to the rules of economic and political wisdom.

Specific Conclusions

As part of a free decision, export licenses or export denials are to be so issued that this will harm neither Austrian economic nor political interests. If, for ecample, the United States makes the delivery of American technology dependent on the fact that Austria, in exporting its own technology, will not circumvent the COCOM restrictions, then this should be an important reason for Austrian foreign trade and foreign policy for deliberation and examination; but the United States cannot expect and assume any right or any decisive influence on the Austrian decision.

This general analysis leads to the following conclusions:

The technology issue is an important issue; guaranteeing the supply of the Austrian economy with foreign high technology and the most unhindered possible export of Austria's own high technology abroad is one of the primary missions of Austrian foreign policy.

The statute of permanent neutrality does not result in any legal limitations on Austrian policy in this field, neither in the field of exporting foreign high technology, nor in the field of exporting Austrian high technology (apart from special rules governing weapons exports).

The transfer of foreign high technology, which was imported on the condition of non-transfer, must be prevented in order not to endanger Austria's supply.

Foreign trade involving Austria's high technology must be developed according to the requirements of foreign-policy and foreign-trade-policy priorities. Here again securing Austrian imports and exports is a top priority. Judgments can be made here only in individual cases according to Austrian viewpoints.

Austria's current legal situation is inadequate because it does not guarantee any effective export controls and because it does not permit punishment of violations, in other words, when delivery restrictions are disregarded. Nor does current legislation make it possible to control the transfer of Austrian technology, in other words, it is impossible to pursue an orderly and meaningful policy here.

The absence of the instruments necessary for an effective Austrian foreign trade policy in the field of high technology is just as familiar to the supplier of high technology as it is to those who profit from smuggling: this is why, on the one hand, there is a crisis of confidence in Austria's ability to comply with delivery restrictions. On the other hand, this situation also is just about a provocation for political pressure against Austria: to guarantee the profit which third countries derive from Austria's function as gateway. Because there are no laws, this political pressure looks promising.

Foreign trade policy and foreign trade instruments of comparable countries, such as Sweden and Switzerland, should be a model here for specific Austrian

steps, with Austria acting quite on its own here and without any pressure. Swiss foreign trade legislation and the Swedish method (using decrees) could be adapted to Austria's legal situation and an important problem could be solved in this manner--either through an amendment for the foreign trade law or by changing the weapons export law.

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